

CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

- 1 1. A method for detecting molecules, the method comprising:
 - 2 a) determining the electronic status of a semi-conductor;
 - 3 b) establishing electronic communication between the molecules and
4 the semiconductor;
 - 5 c) subjecting the semi-conductor to energy influx;
 - 6 d) redetermining the electronic status of the semi-conductor.
- 1 2. The method as recited in claim 1, wherein the energy level is deter-
2 mined optically.
- 1 3. The method as recited in claim 1, wherein the energy level is deter-
2 mined electrically.
- 1 4. The method as recited in claim 1, wherein the semiconductors are
2 are octahedral metal oxides.
- 1 5. The method as recited in claim 1, wherein the semiconductors are
2 metal oxides selected from the group consisting of TiO_2 , VO_2 , ZrO_2 , Fe_3O_4 , MnO_2 ,
3 NiO , CuO , and combinations thereof.

1 6. The method as recited in claim 1 wherein bidentate moieties are
2 positioned intermediate to the molecules and the semiconductors.

1 7. The method as recited in claim 6, wherein the moieties are
2 dihydroxyl phenyls selected from the group consisting of 1,2 dihydroxyl
3 phenylamine, 1,2-dihydroxyl phenyl alanine, 1,2-dihydroxyl benzoic acid, 1,2-
4 dihydroxy glycine, 1,2 dihydroxy benzyl amine, and combinations thereof.

1 8. The method as recited in claim 1, wherein the semiconductor further
2 comprises a valence band and a conductive band, whereby the valence band
3 contains electrons.

1 9. The method as recited in claim 8, wherein the energy influx induces
2 the electrons to relocate to the conductance band.

1 10. The method as recited in claim 1 wherein the molecules are electron
2 donators.

1 11. The method as recited in claim 1 wherein the molecules are electron
2 acceptors.

1 12. A method for detecting biological molecules, the method comprising:
2 a) supplying a semi-conductor having a first energy level and a second
3 energy level and whereby the first energy level corresponds to a first optical
4 characteristic of the semi-conductor;

5 b) establishing electrical contact between the semi-conductor and the
6 molecules;

7 c) causing electrons to move from the molecule to the second energy
8 level; and

9 d) monitoring any change in the first optical characteristic.

1 13. The method as recited in claim 12, wherein the biological molecule
2 extracts electrons from the semi-conductor.

1 14. The method as recited in claim 12, wherein the biological molecule
2 donates electrons to the semi-conductor.

1 15. The method as recited in claim 12, wherein a bidentate moiety is
2 intermediate to the semi-conductor and the biological molecule.

1 16. The method as recited in claim 12 wherein a moiety capable of
2 withdrawing electrons from the biological molecule is in electrical communication
3 with the molecule.

1 17. The method as recited in claim 12 wherein a moiety capable of
2 donating electrons to the biological molecule is in electrical communication with the
3 molecule.

1 18. The method as recited in claim 12 wherein the semiconductors
2 are octahedral metal oxides.

1 19. The method as recited in claim 12, wherein the semi-conductor is
2 between 1 and 20 nanometers in diameter.

1 20. The method as recited in claim 12 wherein the step of causing
2 electrons to move results in the formation of an oxidative region on the semi-
3 conductor.

1 21. The method as recited in claim 20, wherein the oxidative region
2 facilitates cleavage of molecules.

1 22. A method for detecting target moieties *in situ*, the method
2 comprising:

- 3 a) binding biological material to nanocrystalline semiconductor
4 particles, wherein the material has an affinity to the target moiety;
5 b) facilitating entry of the bound material into an organelle; and
6 c) subjecting the semiconductor to radiation sufficient to produce a
7 charge pair separation on the semiconductor's surface.

1 23. The method as recited in claim 22 wherein the biological material is
2 genetic material.

1 24. The method as recited in claim 22 wherein the organelle is a nucleus
2 of a cell.

1 25. The method as recited in claim 22 wherein the charge pair separation
2 is detected via Electron Paramagnetic Resonance.

1 26. The method as recited in claim 22 wherein the charge separation is
2 detected via an electronic signal.

1 27. The method as recited in claim 26 wherein the signal can be
2 amplified.

1 28. A method for manipulating biological material *in vivo*, the method
2 comprising:

- 3 a) attaching a semi-conductor to a first biological moiety to create a
4 construct;
5 b) inserting the construct into a living organism;
6 c) allowing the construct to migrate to the biological material;

- 7 d) creating a plurality of charges on the construct, wherein the size of the
8 charges and distances between the charges cause the biological
9 material to change in structure.

1 29. The method as recited in claim 28 wherein the biological material
2 comprises molecules selected from the group consisting of nucleotides, nitrogenous
3 heterocyclic bases, amino acids, and combinations thereof.

1 30. The method as recited in claim 28 wherein the charges are created
2 by subjecting the construct to radiation.

1 31. The method as recited in claim 30 wherein the radiation has an
2 energy greater than 1.6 eV.

1 32. The method as recited in claim 28 wherein the radiation has energy
2 ranging from about 1.6 eV to 10 eV.

1 33. The method as recited in claim 28 wherein the step of creating a
2 plurality of charges further comprises subjecting the construct to radiation selected
3 from the group consisting of white light, ultra violet light, X-rays or gamma rays,
4 alpha rays, gamma rays, and combinations thereof.

1 34. The method as recited in claim 28 wherein the biological material is
2 nucleic acid and the construct changes the nucleic acid by cleaving it.

1 35. The method as recited in claim 34 wherein the cleavage occurs when
2 the semiconductor accumulates electrons from the first biological moiety.

1 36. The method as recited in claim 28 wherein the semiconductor is a

2 metal oxide selected from the group consisting of TiO_2 , ZrO_2 , VO_2 , MnO_2 , NiO ,
3 ZnO , CuO , FeO_4 and combinations thereof.

1 37. The method as recited in 1 wherein the biological molecule is
2 nucleic acid having base sequences interspersed with guanine.

1 38. The method as recited in claim 30 wherein the source of radiation is
2 a radioactive isotope selected from the group consisting of phosphorus-32, iodine-
3 123, iodine-131, sulfur-35, selenium-75, technetium-99, yttrium-90 and
4 combinations thereof.

1 39. The method as recited in claim 37 wherein the radioactive isotope is
2 covalently attached to the semi-conductor.